

Invitation for Public Comment on

Dr. Ivan Catton, Dr. Per Peterson, and Dr. Michael Quinn

As Candidates for Appointment to the Diablo Canyon Independent Safety Committee
Term: July 1, 2017 through June 30, 2020

On December 8, 2016, the California Public Utilities Commission (CPUC) announced it was seeking applications from qualified persons to become nominees to fill a vacancy on the Diablo Canyon Independent Safety Committee (Committee) for a three-year term beginning July 1, 2017.

The Committee consists of three members, one each appointed by the Governor, the California Attorney General, and the Chair of the California Energy Commission (CEC). The Committee assesses the safety of the operations of Pacific Gas and Electric Company's Diablo Canyon nuclear power plant and has authority to review quarterly reports and conduct on-site inspections. The Committee reports its observations and recommendations to PG&E annually; the Committee then transmits its report, along with PG&E's response, to the Governor, the California Attorney General, the CEC, and the CPUC.

According to the procedures adopted by the Commission in Decision 07-01-028, the President of the CPUC selects no more than three qualified candidates responding to the request for applications, plus the incumbent member whose term is expiring, if the incumbent consents to reappointment. The CPUC will issue a resolution ratifying the President's selection of candidates for appointment. The Governor shall appoint the Committee member for the term beginning on July 1, 2017 from the list of candidates selected by the President of the CPUC and ratified by the Commission.

Applications were received from Dr. Ivan Catton and Dr. Michael Quinn in response to the CPUC's December 8, 2016 announcement. The incumbent member whose term is expiring, Dr. Per Peterson, informed the CPUC's Energy Division that he consents to reappointment for a new three-year term beginning July 1, 2017. Their qualifications are summarized below.

The CPUC welcomes public comments on the qualifications of Dr. Catton, Dr. Peterson, and Dr. Quinn. Please e-mail comments to david.zizmor@cpuc.ca.gov or mail them to:

David Zizmor
Energy Division, California Public Utilities Commission
505 Van Ness Avenue
San Francisco, CA 94102

Comments must be received (e-mail) or postmarked by February 27, 2017.

Dr. Per F. Peterson (Incumbent)

Per F. Peterson is a professor in the Department of Nuclear Engineering at UC Berkeley. Prior to beginning graduate studies in 1985, he worked at Bechtel National on the design of the Defense Waste Processing Facility that now operates at the Savannah River Plant (South Carolina) to vitrify defense wastes. After completing Masters and PhD degrees in Mechanical Engineering at UC Berkeley between 1985 and 1988, studying passive heat transfer processes, he performed postdoctoral work at the Tokyo Institute of Technology, and was hired as an Assistant Professor at UC Berkeley in Nuclear Engineering in 1990. At Berkeley he has taught extensively in courses related to reactor design and safety. This includes the undergraduate courses NE-161: Nuclear Power Engineering and NE-170: Nuclear Design, as well as the graduate courses NE-260: Thermal Aspects of Nuclear Reactors, NE-267: Nuclear Reactor Safety, and NE-275: Risk Assessment. These courses cover all theoretical and practical aspects of nuclear reactor safety.

His research and publications cover both applied and fundamental topics related to nuclear technology. This work and some 300 research publications have covered topics in nuclear fusion energy, fission reactor design and safety analysis, nuclear waste management, and fundamental topics in heat transfer and fluid mechanics that are relevant to these applications. He is frequently called upon to serve on advisory panels for the federal government, the national laboratories and the national academies on topics related to nuclear technologies, as well as expert panels at academic conferences and workshops.

From 2010 – 2012, Peterson served as a member of President Obama’s Blue Ribbon Commission (BRC) on America’s Nuclear Future, where he co-chaired its Reactor and Fuel Cycle Technology subcommittee with retired Senator Pete Domenici. The BRC provided recommendations to the Administration, Congress, and the DOE on strategies to manage U.S. spent fuel and high level wastes. These recommendations have clear relevance to California, including defining the national approach to manage used fuel left at decommissioned reactor sites that include Rancho Seco, Humboldt Bay, and San Onofre in California.

He is also currently Executive Associate Dean of the College of Engineering, and is a former chair of the Department of Nuclear Engineering and of the Energy and Resources Group, at UC Berkeley. He is a Fellow of the American Nuclear Society and a former chair of its Thermal Hydraulics Division. He previously chaired the Radiation Safety Committee for UC Berkeley, which is regulated by the California Department of Public Health and is responsible for reviewing all authorizations for radioactive materials and radiation producing machines used in research on the Berkeley campus, and he is chair of the Reactor Safeguards Committee for the Aerotest Research Reactor in Pleasanton, California. In 2004, he was appointed to the Diablo Canyon Independent Safety Committee by the Attorney General and served until 2007; he was appointed to the Committee again in 2008 by the Governor and re-appointed in 2011 and 2014.

Dr. Ivan Catton

Professor Catton began his teaching career at UCLA in 1967 where his major areas of teaching and research were thermodynamics, heat transfer, and fluid mechanics. In 1974 he became a consultant to the Advisory Committee on Reactor Safeguards (ACRS) at the request of Professor David Okrent (the father of probabilistic safety analysis). To gain the requisite knowledge of nuclear reactor plants, Professor Catton taught every undergraduate nuclear engineering course given at UCLA and took on the job of director of the UCLA nuclear reactor facility where he was responsible for teaching and licensing many UCLA students to operate the UCLA Nuclear Reactor.

Prof. Catton's career spans more than fifty years in both research and industrial applications in the field of heat transfer, ranging from aerospace systems to electronic devices and nuclear power plant design. In 1981, he received the Heat Transfer Memorial Award from the American Society of Mechanical Engineers (ASME), one of the most prestigious awards in the field. In 2009, he received the Max Jakob Award from ASME and the American Institute of Chemical Engineers for excellence in heat transfer research and engineering. Dr. Catton has been involved in the study and design of nuclear power plants, water desalination plants, use of solar power, aerospace heat transfer for re-entry vehicles, and - more recently - optimum design of heat exchangers.

Prof. Catton spent most of his technical career as either a consultant to or a member of the ACRS, an advisory committee to the commissioners of the U.S. Nuclear Regulatory Commission (NRC). This experience began with the safety review of the CRBR where liquid metal heat transfer was the focus of his efforts, followed with BWR suppression pool problems related to the LOCA. He was the ACRS representative at Three Mile Island (site 2) during the accident and subsequent stabilizing of the plant. Severe accidents then became important and he and his colleagues at UCLA gave technical assistance to the NRC in this area. With Prof. Okrent's arrival at UCLA, Prof. Catton became more involved with licensing issues at various nuclear power plants around the country. All aspects of nuclear power came under the auspices of the ACRS and in this capacity Prof. Catton consulted on a large number of plant-specific subcommittees. Prof. Catton's research in the nuclear safety area has dealt with core melt problems and steam explosions, BWR suppression pool loading, water hammer, steam generator tube vibration, and loose parts induced wear among others. More recent nuclear research activities were in two areas. The first area was the result of a study supported by the NRC on Accident Management which resulted in several publications including an invited paper in *Nuclear Engineering and Design*, and an invitation by the International Atomic Energy Committee to evaluate the Krsko nuclear power plant accident management program. The second area of study was steam generator tube vibration and loose parts wear. This work extended the state of the art in vibration prediction for single phase flow over tube bundles by predicting the onset of vibration without resorting to use of experimental data, a first for rod bundles. An invited paper appeared in *Nuclear Engineering and Design* that summarizes this work where results for two-phase flow were also included. Another paper in the same journal addresses the issue of dry out and heat up of a reactor core following a severe accident. This work placed UCLA at the forefront of nuclear power plant severe accident research, culminating

with Dr. Catton being named general chairman of the sixth International Post Accident Heat Removal Information Meeting held at UCLA in 1986 and co-chair of a similar meeting held in Dubrovnik in 1989.

During 1988, Dr. Catton participated in an effort to establish the uncertainty in calculated reactor system behavior following a major loss of coolant accident. The results of this work led to five publications in *Nuclear Engineering and Design*. Prof. Catton's group brought together the results of a \$1.5B research program spanning a fifteen year period. The work underwent peer review by eminent researchers and was judged to be the first of its kind. A second such study addressing severe accidents (which led to elimination of the DCH issue) was initiated by the NRC, but Prof. Catton's appointment to the ACRS limited his involvement to oversight. Dr. Catton was the ACRS representative to the Steam Generator, Safety Stop Valve and Check Valve Owner Groups. As an independent consultant following his ACRS membership, Dr. Catton addressed issues like core axial power distribution and erosion of shutdown margin (SDM) attributing to crud buildup on the nuclear fuel and subsequent boron deposition in the crud layer, and steam generator tube vibration at SONGS.

Prof. Catton became a member of the ACRS in 1989 and served until of 1997. Any safety issue arising in the nuclear industry is within the charter of the ACRS and every licensed plant must have an ACRS letter of review. Prof. Catton's area of responsibility on the committee was thermal hydraulics where he was instrumental in moving the industry towards the use of best estimate computational tools and played a strong role in the licensing of the new Westinghouse passive nuclear reactor (AP600). He was also a member of the Savannah River Laboratory Severe Accident Advisory Panel where he reviewed all severe accident-related work.

While an ACRS member, Professor Catton was chairman of the Thermal/Hydraulics and Fire Protection subcommittees, and a member of the Severe Accidents, PRA, and Human Factors subcommittees. He was instrumental in formulating ACRS comments and recommendations on a number of LWR technical issues, including:

- ◆ Post TMI-2 lessons learned review;
- ◆ Advanced code development (RELAP5 and TRAC) ;
- ◆ Determination of the uncertainties in best estimate calculations of LOCAs (CSAU);
- ◆ Sump screen and suction strainer blockage issues at LWR plants;
- ◆ Post-accident level monitoring in LWRs;
- ◆ Development of a regulatory guide on instrumentation to follow the course of an accident;
- ◆ Steam generator overfill, multiple tube rupture, and the Steam Generator Rule;
- ◆ Chilled water system reliability and pump seal issues;
- ◆ AP600, ABWR, SBWR and CE System 80+ DBAs, Fire protection and Severe Accidents;
- ◆ Review of the EPRI ALWR Utility Requirements Document;
- ◆ Risk-Based Fire Protection Rule and resolution of the Thermo-Lag Fire Barrier Issue;
- ◆ NRC Standard Review Plan for risk-based regulation; and

- ◆ Westinghouse Best Estimate LOCA methodology and Simulator fidelity.

Following his service on the ACRS, Professor Catton became a consultant to the Congressional Nuclear Waste Technical Review Group to help in evaluating the use of various means of predicting the long term evolution of stored waste at Yucca Mountain. He was also a consultant to the NRC on the impact of SBLOCA on PTS and to EPRI on the crud/boron issue, he participated in a review of the Diablo Canyon Seismic Design, and attended the final ACRS subcommittee meeting held at San Luis Obispo High School.

Professor Catton's broad range of experience will enable him to effectively serve on the Diablo Canyon Independent Safety Committee.

Dr. Michael Quinn

Dr. Quinn has invested over forty years into the public health and safety of nuclear industry operations, including twenty-five years in power block operations at a nuclear power station, and the past sixteen years as a consultant to the nuclear industry in the U.S. and Canada. Michael's collective past and currently applied nuclear power experience is congruent with the Diablo Canyon Independent Safety Committee's (DCISC) requirements and mission. He can bring current, comprehensive nuclear operations assessment experience to complement the depth and breadth of the Committee's members.

Equally important as his applied operational experience and academic background, Dr. Quinn can bring to the DCISC a demonstrated history of articulating his assessments in an objective, empirically based, and plain language manner to the full spectrum of stakeholders (e.g., the public, interest groups, station staff, the boardroom, utility commissions, and regulators, among others).

1975-1999 Qualification Experience

While in the power block of a nuclear unit with a large nuclear utility from 1975 to 1999, Michael earned a U.S. Nuclear Regulatory Commission (NRC) Senior Reactor Operator License on a Pressurized Water Reactor unit (PWR), and held leadership positions that included Director of Nuclear Station Services; Nuclear Plant Operations Review Committee (PORC) and Corrective Action Review Board (CARB) Chair and Member; Director of Nuclear Station Emergency Operations; Refueling and Maintenance Outage Shift Manager; Nuclear Station Duty Officer; Manager of Chemistry and Radiochemistry; and Project Manager, reporting to the President, on a three-unit, four year Station Recovery Team.

During this time, Michael was part of, and frequently at the center of, many documented nuclear station challenges and operational evolutions, planned and unplanned. Michael was a member of the senior station leadership team at Haddam Neck Station, a nuclear unit that continuously performed at NRC SALP-1 and INPO-1 performance levels (presently termed US NRC Column 1 and INPO-1).

1999-2017 Qualification Experience

Since 1999 Michael has been engaged in the safe operation of nuclear units, as well as in the new build, refurbishment, and decommissioning sectors of the nuclear industry while consulting to more than two dozen nuclear units and facilities in the U.S. and Canada, often in the power block.

During these past sixteen-plus years, Michael has been, and is presently: conducting station and licensee program and operational assessments on operational aspects of nuclear organizations; performing root cause evaluation on significant events; and leading recovery project management for nuclear licensees and suppliers.

In addition, Dr. Quinn continues to assess and remediate licensee and supplier organizational and corrective action programs; provides PI&R, Human Performance, and Safety Culture coaching and training; and provides related consulting services to several nuclear industry sectors. These sectors include the commercial nuclear power industry in the U.S. and Canada; U.S. Government (e.g., NRC, U.S. Department of Energy); and nuclear supplier organizations (large nuclear steam supply system providers as well as smaller nuclear suppliers to the new builds in South Carolina and Georgia).

Selected nuclear safety and culture issues that Dr. Quinn has successfully dealt with include: significant safety issues in a high-level trans-uranic nuclear waste underground facility; consequential design phase issues on the ‘new build’ project for North Anna 3; significant safety issues on the disassembly and reassembly of components on two CANDU reactors under refurbishment; Loss of Offsite Power to the Operations power block of a 1200 MWe nuclear unit; nuclear fuel handling project upgrade failures at five separate nuclear sites involving distinctly different failures during a four month refueling season; a Nuclear unit cooling tower failure; team member of a reliability assessment of Vermont Yankee; Collective Significance assessment on six safety systems’ performance challenges at a PWR; causal analysis of safety related flow control valve erratic operation; Collective Significance on Spent Fuel Transfer issues at a decommissioning station; Collective Significance of five nuclear fuel handling project upgrade failures; components that did not meet acceptance criteria at each of the four ‘new build’ nuclear units in SC and GA; significant transuranic (alpha) ingestion/ uptake by over 500 craft workers at a nuclear power station; technical, radiological, and safety culture issues significantly impacting a Decontamination and Decommissioning (D&D) campaign at a waste recovery site.

From a major nuclear industry ‘campaign’ perspective, Dr. Quinn has been and is still engaged in industry issue campaigns and challenges that include: safety culture challenges to nuclear operations; post-accident industry response and subsequent upgrades; containment sump screen upgrade (GSI-191); groundwater tritium; safeguards; nuclear fuel handling; Independent Spent Fuel Storage Installations (ISFSI); uptake of trans-uranics to workers; corrective action program challenges, notably 10 CFR 50 Appendix B Criteria; Nuclear Promise Efficiency Bulletins; and no less importantly, the impact that a ‘final shutdown decision’ (as Diablo Canyon is facing within eight years) has had on nuclear station staffs’ performance while trying to maintain focus on operational excellence.

Michael has led numerous nuclear organizational assessments (and, in several cases, recoveries), and has also responded to a large number of programmatic breakdowns that have impacted Conduct of Nuclear Operations, Safety Culture, Corrective Action Programs, equipment operability, training programs, and management/personnel effectiveness at nuclear units.

Starting in 2006 and continuing into 2017, Dr. Quinn has trained NRC inspectors and technical staff in a concentrated three-day course on the selection and engagement of

assessment tools and processes to evaluate significant nuclear licensee event and incident reports. During these past ten years he has trained over 600 inspectors and technical staff. In late February 2017, Dr. Quinn will provide this three-day assessment training to the first cohort from the Japan Nuclear Regulation Authority.

LICENSES/CERTIFICATIONS CONTRIBUTORY TO A POTENTIAL POSITION ON THE DCISC:

- ◆ U.S. NRC Senior Reactor Operator License #10071 (now inactive) on a Westinghouse PWR (Diablo Canyon is a Westinghouse PWR design)
- ◆ Certified Root Cause Investigator:
 - Nuclear Safety Review Concepts Event Evaluation
 - FPI/PII Prevention/ Reduction of Organizational & Programmatic Failures
- ◆ Certified Root Cause Trainer
- ◆ Certified Radiation Safety Officer

Dr. Quinn earned a Doctorate in Organizational Management Systems (organizational system dynamics) and Executive Master of Business Administration degrees from the University of New Haven. He had previously earned a Bachelor of Science degree in Chemistry from Charter Oak College.

In summary, Michael brings directly applicable past and current nuclear industry analysis experience and assessment results for your consideration of his candidacy regarding an appointment to the Diablo Canyon Independent Safety Committee.

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